Low-Level Radioactive Waste in Michigan

A Survey of Radioactive
Waste Generators

State of Michigan
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Statutory Basis

Section 18(a) of 1994 PA 434 requires generators of low-level radioactive waste (LLRW) to annually report to the Michigan Low-Level Radioactive Waste Authority certain information on the volume, type, and activity of the LLRW produced. This report is a summary of the information submitted for calendar year 2002.

Introduction

Commercial LLRW is a by-product of radioactive materials used in nuclear power plants, industry, and medical and research institutions. It comes in very diverse forms, including laboratory equipment, sealed radiation sources, wiping rags, protective clothing, hand tools, vials, needles, filter resins, and metallic reactor components.

Through the 1970s and 1980s, only three disposal facilities in the nation were licensed to accept commercial LLRW. The states in which these facilities were located (Nevada, South Carolina, and Washington) did not want to continually bear sole responsibility for the nation's LLRW and urged Congress to take action to avoid a disposal capacity crisis. The resulting federal Low-Level Radioactive Waste Policy Act of 1980, and the Policy Amendments Act of 1985, establish the requirement that each state, acting alone or in cooperation with other states through an interstate "compact," is responsible for providing disposal capacity for the LLRW produced within its borders.

Michigan Low-Level Radioactive Waste Authority

The Michigan Low-Level Radioactive Waste Authority (Authority) was established by the Low-Level Radioactive Waste Authority Act, 1987 PA 204, as amended (Act 204), to fulfill the state's responsibility under federal law to provide for the careful isolation of the LLRW produced by Michigan's hospitals, universities, industry, and nuclear power plants. A summary of Michigan's efforts to site and develop a waste isolation facility is presented below.

The continued availability of out-of-state disposal options, along with the dramatic decline in waste volumes being generated nationally and within Michigan, has caused the focus of the Authority to shift away from facility siting to take a broader perspective on radioactive waste. While the Authority is no longer actively pursuing the development of a waste disposal facility in Michigan, it continues to monitor the generation and disposal of LLRW by Michigan's utilities, hospitals, universities, and other waste generators. The Authority also tracks policy developments in other states and compacts that could affect the availability of waste disposal options and helps to analyze, develop, and direct policy regarding radioactive waste management and disposal.

The Authority has become involved in planning and preparation for the eventual shipment of spent nuclear fuel from Michigan's four nuclear power plant sites to a federal waste repository. Staff participates on regional and national committees focused on assuring state involvement in routing decisions and emergency response planning.

With the 1996 transfer of the Authority into the Michigan Department of Environmental Quality (MDEQ), the Authority also works closely with staff of the Waste and Hazardous Materials Division, Hazardous Waste and Radiological Protection Section, on other radioactive waste and radiation safety issues relevant to protecting Michigan's citizens.

Michigan's Low-Level Radioactive Waste Facility Siting Efforts

In 1982 Michigan joined the Midwest Interstate Low-Level Radioactive Waste Compact (Compact), along with the states of Indiana, Iowa, Minnesota, Missouri, Ohio, and Wisconsin. In 1987 because Michigan produced more LLRW than any of the other states, the state was selected to serve as the first "host state" for the Compact. As the first host state, Michigan would be responsible for siting, developing, and operating a LLRW disposal facility for a period of 20 years. After that point, the responsibility would shift to another state. The Michigan siting effort began with the passage of Act 204 that established the Authority, a site selection process, and minimum statutory siting criteria.

Following a statewide site screening study conducted by researchers at Michigan State University, the Authority announced in October 1989 the selection of three "candidate areas." These three areas were the largest of 81 parcels of land that survived the statewide screening process and could, therefore, be considered potentially suitable to host an LLRW disposal facility. The Authority studied these three areas in greater detail and, by May 1990, concluded that none of the three would likely meet all the statutory siting criteria. These three areas were eliminated from further consideration.

As a result of this process, authorities in the three "sited states" (Nevada, South Carolina, and Washington) considered Michigan to be out of compliance with the milestones set forth in the Policy Amendments Act of 1985. Provisions of that law gave the sited states the authority to monitor the progress of states and compacts toward development of disposal facilities and to deny access to the operating disposal facilities to generators in any state or compact that was considered out of compliance with the federal milestones. In July 1990 Michigan received warnings from Nevada, South Carolina, and Washington that, unless Michigan revised its siting criteria to be less restrictive or identified three candidate sites, access to the disposal facilities would be terminated. Access was terminated in November 1990. Michigan generators were forced to store LLRW on-site for almost five years before access to the facility in South Carolina was restored in July 1995.

With the elimination of the three candidate areas, the Midwest Interstate Low-Level Radioactive Waste Compact Commission (Commission) also became concerned that the Michigan siting process was not making adequate progress toward siting and developing a facility. The Commission did not accept the Authority's budget request for 1991, but rather passed a reduced budget that included a number of contingencies. The contingencies included the requirement that the State Legislature amend the siting criteria embodied in Act 204. These contingencies were unacceptable to the Authority. As a result of this impasse, the Commission forwarded no additional funds after August 1990. In July 1991 the Commission voted, over Michigan's objections, to revoke Michigan's membership in the Compact. The state of Ohio then became the designated host state for the Compact.

Since 1991, Michigan has not had an active siting process. Several studies have been completed that have provided further insight and policy direction. A study conducted by the Authority's technical services contractor in 1993 confirmed that it was very unlikely that any place in the state would meet the statutory siting criteria. A report issued in 1995 by the Low-Level Radioactive Waste Board of Governors called for major revisions in state law in order to establish a credible siting process. The two major recommendations made in the report were that: (1) a "volunteer community" siting process should be established, in place of the top-down, state-driven technically-complex siting process and (2) the state's siting criteria ought to be replaced with federal technical requirements and licensing standards. In 1996 legislation that would put these recommendations into law was introduced, but it was not acted on by the State Legislature. Because of the continued decline in waste volumes generated and the continued (though uncertain) access to disposal sites, no effort is currently underway to amend the legislation.

The National Scene

A total of 44 states now comprise ten interstate compacts. Six states (Massachusetts, Michigan, New Hampshire, New York, North Carolina, and Rhode Island), along with the District of Columbia, are not affiliated with compacts.

States and compacts have failed to implement the federal law as it was initially envisioned. New disposal capacity was to have been created by 1996, but not one new facility has been established within the framework of the compact system. In the early 1990s about a dozen siting processes were underway. Currently, most of them are either at a standstill or have been completely abandoned. The failure of these siting efforts has been due to dramatic reductions in waste volumes over the past decade, ever-escalating costs of site investigation and licensing, political and public opposition, and the continued availability of disposal options.

Some recent progress has been made by one interstate compact. The state of Texas enacted legislation in June 2003 that allows for the creation of two privately operated waste disposal facilities to be licensed at one site. One facility would dispose of waste from federal facilities (predominantly from cleanup of U.S. Department of Energy facilities). The other facility would serve as the disposal site for the three states of the Texas Compact (Texas, Vermont, and Maine). While the Texas legislation provides some latitude for that facility to accept waste from other states, it is uncertain whether or under what conditions non-Compact waste would be received.

A number of lawsuits have been filed over the failures in siting processes. U.S. Ecology, the siting contractor for the state of California, has sued California over its abandonment of its siting process. Several states of the Southeast Compact have sued the state of North Carolina, and the Central Compact Commission has sued the state of Nebraska. In both of these cases, the host state is being sued for monetary compensation of the Compact. A district court ruling in September 2002 ruled in favor of the Central Compact, and ordered the state of Nebraska to pay $151 million to the Compact. The ruling is being appealed.

Operating Disposal Facilities

Currently, there are two operating facilities in the nation that accept the full range of LLRW. Both of these facilities were operating at the time that the federal Low-Level Radioactive Waste Policy Act of 1980 was enacted.

The U.S. Ecology facility in Hanford, Washington, is accepting waste only from the eight states of the Northwest Compact and, by contractual agreement, the three states of the Rocky Mountain Compact. While this facility was not established under the framework of the compact system, it is the one facility that is now being operated as a regional facility.

The Duratek, Inc., facility in Barnwell, South Carolina, is now accepting waste from all states except those with access to the disposal site in Washington. Michigan generators regained access to this facility in July 1995 after almost five years of forced on-site storage of LLRW.

One other waste disposal site accepting certain types of LLRW is the Envirocare, Inc., facility located in northwest Utah. This facility initially accepted only large-volume, low-activity wastes, such as decommissioning debris waste and contaminated soils from site remediation projects. Recent permit modifications, however, now allow Envirocare, Inc., to accept all Class A LLRW.[1] The company has also pursued a license to accept Class B and C wastes. The state of Utah's

[1] A description of waste classes is included in the next chapter.

Division of Radiation Control approved the license in July 2001. However, before the license is effective, Utah law requires that the Legislature and the Governor must both approve the decision. Envirocare, Inc., has not yet pursued those approvals.

The Duratek, Inc., facility has been accepting for many years most of the nation's operational waste volumes and the overwhelming percentage of curies. Currently the facility accepts waste from all states except the member states of the Northwest Compact. However, statutory changes by the state of South Carolina will dramatically affect this facility's operations in coming years.

With legislation enacted in June 2000, the state of South Carolina joined with the states of Connecticut and New Jersey, of the Northeast Compact, to form the "Atlantic" Compact. As the host state for this new Compact, South Carolina is able to restrict access of non-Compact states to the Duratek, Inc., disposal facility.

The legislation establishes a maximum yearly volume cap for the disposal facility and a timetable for the gradual reduction in that annual volume. The volume restrictions will be borne solely by the states that are not members of the Atlantic Compact. Moreover, the legislation prohibits the site from accepting out-of-compact waste beginning in 2008.

Summary

The national LLRW scene has changed dramatically since the passage of the federal Low-Level Radioactive Waste Policy Act of 1980. Waste volumes have been reduced dramatically, in part due to the tremendous increases in cost of disposal. In 1990 processes to site new disposal facilities were underway in about a dozen states. Today, only one compact siting process can be considered "active." It is questionable whether the remaining compacts could resume earlier siting efforts, even if access to currently operating sites is lost.

The gradual loss of access to the Duratek, Inc., facility in South Carolina that generators in Michigan and many other states will experience may pose problems for the disposal of Class B and C wastes. It is possible that the Envirocare, Inc., facility may be licensed to receive Class B and C wastes by that time. If not, generators in Michigan and many other states will have to store such wastes or take steps to avoid generating them.

What is Low-Level Radioactive Waste?

Radioactive materials have many different uses. They are used in medicine, scientific research, and industry and to help generate electricity. Doctors have learned many different ways to use radioactive materials in the treatment and diagnosis of diseases, including cancer. Radiation is also used to label substances so scientists can trace the path of the material through living plants and animals. Plants are sometimes treated with radiation to develop new strains of seeds and to control bacteria. Industry performs radiography with radioactive sources to check the quality of products. Radionuclides are used in thickness gauges, for analyzing evidence from the scene of a crime, for preserving food, for dating art and antiques, and to generate about 20 percent of the nation's electricity. The use of radiation or radioactive materials sometimes results in the creation of LLRW.

The federal government defines LLRW as "radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or byproduct material as defined in section 11e.(2) of the Atomic Energy Act [of 1954]." Virtually all radioactive waste from hospitals, universities, government institutions, and industry is considered low-level waste. All radioactive wastes from nuclear power plants are considered low-level, except for the spent nuclear fuel assemblies and certain irradiated reactor components.

While the levels of radiation from LLRW are lower than those of high-level waste (which is mostly spent fuel rods from commercial power facilities), low-level wastes still pose a safety hazard and must be safely and carefully isolated until the radionuclides have decayed to nonhazardous levels. LLRW is classified as either Class A, B, or C waste, depending upon the radionuclides present in the waste and the concentration of curies contributed by those radionuclides. Federal regulations defining the waste classes are embodied in Title 10 of the Code of Federal Regulations, Part 61.55 (10 CFR 61.55).

Class A: LLRW that has the largest volume but lowest concentrations of long- and/or short-lived radionuclides. Most Class A waste decays to a level that no longer poses a hazard within 100 years. Class A waste includes most LLRW from hospitals and universities and the majority of waste from nuclear power plants.

Class B: LLRW that has small volumes but intermediate concentrations of long- and/or short-lived radionuclides. Class B wastes must meet more rigorous waste form requirements than Class A to ensure stability. Most Class B waste decays to a level that no longer poses a hazard within 100 to 300 years. Class B waste can include certain radiopharmaceutical wastes, sealed sources, and some ion exchange resins from nuclear power plants.

Class C: LLRW that has the smallest volumes but the highest concentrations of long- and/or short-lived radionuclides. Class C wastes must meet more rigorous waste form requirements to ensure stability and must be disposed of at a depth of at least five meters below the surface or be disposed of with intruder barriers. Most Class C waste decays to a level that no longer poses a hazard within 500 years. Class C waste is limited almost exclusively to some ion exchange resins, some sealed sources, and activated metal components from nuclear power plants.

It is important to note that all of the waste classes can contain radionuclides with long half-lives. It is the concentration of the radionuclides within a waste material, more than the half-life of the radionuclides present, that often determines the class of waste.

The following list shows typical waste forms by generator category. The majority is classified as Class A waste.

Utility: Spent resins, filter sludges, dry compacted waste, irradiated components, contaminated plant hardware, evaporator bottoms, and concentrated waste

Academic: Compacted trash or solids, institutional laboratory or biological waste, animal carcasses, and absorbed liquids

Medical: Compacted trash or solids, institutional laboratory or biological waste, absorbed liquids, sealed sources, gloves, vials, and syringes

Industrial: Depleted uranium, compacted trash or solids, contaminated plant hardware, sealed sources, watches and clocks, and instruments using radioluminescent paint

Government: Compacted trash or solids, contaminated plant hardware, and absorbed liquid

All categories may include contaminated gloves, clothing, tools, wood, cloth, metals, plaster, building rubble, incinerator ash, and paper.

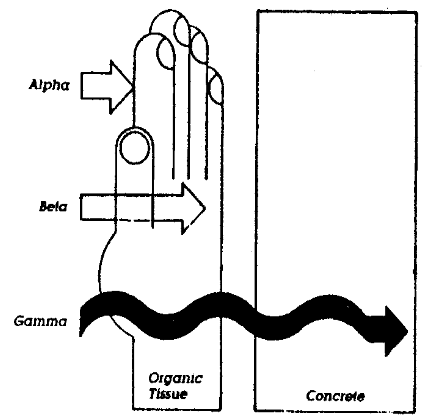
Mixed Waste: Waste material that contains radioactive constituents, as defined under 10 CFR 61, and hazardous constituents, as defined under federal hazardous waste rules in 40 CFR 261. Both the radiological and chemical hazard of the mixed waste must be considered in the management and disposal of this waste. Small volumes of mixed waste can be generated in a variety of applications. However, because of the dual regulatory scheme that must be considered with mixed waste, most licensees try to avoid generating mixed waste. In some mixed waste, the radioactive constituents may have short enough half-lives to allow storage for decay. In other instances, mixed waste can be treated to eliminate the hazardous properties so that the waste can then be handled as LLRW.

Radiation

In 1896 a physicist named Antoine Becquerel discovered radioactivity. Although radiation and radioactive materials are now used in many different ways in our modern society, few people truly understand what radioactivity really is.

Atoms are made up of three particles: electrons, protons, and neutrons. Electrons have a negative charge and travel around the nucleus, which consists of protons and neutrons. Protons have a positive charge, and neutrons have no charge. Atoms can exist in various states of energy. Some of these states are stable and some are unstable. In order to become stable, the atoms emit particles or energy. Those particles and energy are known as radiation.

There are three common types of radiation called alpha, beta, and gamma. Alpha particles consist of two protons and two neutrons. They can be stopped by a sheet of paper and do not penetrate the skin. They can be hazardous, however, if swallowed or inhaled. The second type of radiation is beta. A beta particle is a high-speed electron that originates from the nucleus. Most of these can be stopped by a thin sheet of metal. Like alpha particles, they are most hazardous if swallowed or inhaled. The last type of radiation is gamma. Gamma rays are like x-rays but can be more energetic. This is the most penetrating type of radiation. It takes a few inches of concrete or lead to stop a high-energy gamma ray. If too much radiation is received, it can cause damage to human tissue.



Why are some materials radioactive? Some atoms are naturally radioactive. The most commonly known radioactive element is uranium. Others include radium, polonium, and radon. Certain “isotopes” of other smaller elements are also naturally radioactive. An isotope is one of two or more nuclides with the same atomic number (the same chemical element) but with different atomic weights. For instance, tritium (H-3) is a radioactive isotope of hydrogen. Carbon-14 is a natural radioactive isotope of carbon. Certain stable atoms can be made radioactive by high energy bombardment of the nucleus in a nuclear reactor or by a particle accelerator beam. Finally, some radioactive atoms result when a nucleus is split, such as occurs in a nuclear fission reaction.

“Nuclide” is the term used to refer to one type of atom characterized by its mass number, atomic number, and energy state. Nuclides may be stable or radioactive. “Radionuclide” is the term used to refer to any nuclide that is radioactive.

After a period of time, radioactive materials become nonradioactive. This will depend on the material’s half-life. Each radionuclide has a characteristic half-life. “Half-life” is the length of time required for half of the atoms of a radionuclide to decay into another nuclide. For example, if we had 20 grams of tritium, which has a half-life of 12.3 years, in 12.3 years only 10 grams of tritium would be left. In 24.6 years we would have 5 grams left, etc. Half-lives range from fractions of seconds to billions of years depending on the radionuclide.

Radionuclides and Radiological Risk

The hazard that a particular radionuclide might pose can be confusing. Often, people equate half-life with hazard (i.e., the longer the half-life, the greater the hazard). Also, it is a common misperception that Class A waste is made up of short-lived radionuclides and that all long-lived radionuclides are classified as Class C waste. Actually, half-life has only some bearing on the hazard posed by a radionuclide and the waste class into which a particular nuclide would be placed. Other factors are often of greater importance than half-life in dictating the relative hazard that a radionuclide poses to humans and the waste class into which a particular nuclide would be placed.

The type of radiation - alpha, beta, or gamma - will have a bearing on the hazard. As noted above, alpha emitting radionuclides are most hazardous when ingested or inhaled.

The "activity" of a radioactive element, measured in curies, indicates the rate of radioactive decay. One curie is equal to about 37 billion disintegrations per second. The curies present in any batch of low-level waste will depend on the radionuclides present and the concentrations or total amount of those nuclides.

A misconception about activity is that the higher the activity, the more dangerous the material. This is not always true. Different radionuclides give off different types of radiation at different energy levels. A material that emits ten alpha-particles each second may pose less of a hazard than another material that emits one gamma ray every second. Because alpha-particles can be easily stopped and gamma-rays cannot, more shielding precautions must often be taken when working with gamma emitters.

The **energies** released through different types of radiation differ substantially. Even within a particular type of radiation, the energies can differ substantially. For example, carbon-14 and tritium (a radioactive isotope of hydrogen) are weak beta emitters. The betas from tritium are stopped by only a few millimeters of air and present no health hazard unless ingested or inhaled. The beta particles emitted from phosphorus-32, however, are of much higher energy and can penetrate into the body from the outside.

The **half-life** of a radionuclide is simply a measure of the time required for half of the atoms of a radionuclide to decay into another form. Elements with a very long half-life are only mildly radioactive since they are decaying so slowly. For instance, the principle isotope in natural uranium has a half-life of 4.5 billion years, which is why it is still relatively abundant. Thorium-232, a naturally radioactive element used for many years in lantern mantles, has a half-life of 14 billion years. The half-life will dictate the length of time that a particular radionuclide may be of concern. Phosphorus-32, mentioned above, has a half-life of 14 days. After about four months in storage (about 10 half-lives), there will be very little radioactivity left. Tritium has a half-life of 12 years; any tritium that is disposed in a LLRW facility will be decayed away in about 120 years. Carbon-14, with a half-life of over 5,000 years, will be present in a LLRW facility for centuries.

The **hazard** that a particular radionuclide poses to people is a function of the type of radiation emitted, the amount of the radionuclide (and thus the curies) present, the energies involved and how the body reacts to a particular isotope if it is ingested. The half-life of the radionuclide only dictates how long that particular hazard will exist. The hazard posed by iodine-129, for example, is due to the body's concentration of iodine in the thyroid gland. The fact that it has a half-life of 16 million years makes it a long-term isolation concern if any appreciable quantity is to be present in a waste facility.

The U.S. Nuclear Regulatory Commission (U.S. NRC) has established a waste classification system in 10 CFR 61.55 that is based on the hazard that particular radionuclides may pose to humans over the long term. As such, the principle considerations in the classification scheme are the particular radionuclides present, their half-lives, and their concentration in curies per cubic meter. As a result, Class A and B waste can contain low concentrations of radionuclides with long half-lives, such as iodine-129. Conversely, Class C waste is made up largely of activated metal components from nuclear reactors, where the principle nuclide present is cobalt-60, with a half-life of 5.3 years.

Purpose of Survey

Beginning in late 1990, Michigan generators of LLRW were forced to store their waste on-site because they were denied access to the nation's disposal facilities. In 1992 the Authority conducted a survey of waste generators to determine:

- The number of facilities producing and storing LLRW;
- The volume of waste produced annually;
- The volume of LLRW in storage;
- What capacity facilities had to continue to store LLRW;
- The characteristics of the waste in storage, including waste form, principle radionuclides, and activity level; and
- The impacts and costs associated with the need to provide on-site storage.

The 1992 survey was mailed to about 700 facilities that were licensed by the U.S. NRC or registered by the former Michigan Department of Public Health. The survey results showed that while the use of radioactive materials is widespread, only a small portion of all licensees produce waste that must be disposed in an LLRW disposal facility.

In 1994 the Michigan Legislature enacted amendments to Act 204, requiring that generators report annually to the Authority on the volume of waste being produced and in storage and other information on the generation and management of LLRW. The Authority is required to prepare a report to the Legislature summarizing the results of the data received from waste generators. The generator survey and this report fulfill the reporting requirements of Act 204.

Surveys conducted between 1994 and 1999 included only those facilities that had indicated in the initial 1992 survey that LLRW was generated at the facility, along with the few facilities that had been licensed after 1992. This 2002 survey, once again, was sent to all entities within Michigan that are either licensed with the U.S. NRC or registered with the MDEQ's Radiological Protection Program – 983 facilities.

Survey responses were received from 502 facilities. A majority (286) of these entities did not produce any LLRW. Another large portion of the total respondents (179) indicated that the only LLRW they generated contained radionuclides with such short half-lives that the waste could be stored until the material was no longer radioactive.

A total of 36 respondents indicated that they did generate LLRW in 2002 or were still storing LLRW that had been previously generated. The focus of this survey report will be on this small group of respondents.

General Findings

The Authority's survey for 2002 was mailed to almost 1,000 entities in the state of Michigan: colleges and universities, business and industry, medical facilities, power utilities, and some governmental agencies. Each entity was either licensed by the U.S. NRC or registered with the MDEQ to possess or use radioactive materials. The Authority received 502 responses to this survey.

The largest portion of these entities (286) hold licenses for the use of sealed sources. A sealed source is a radioactive material sealed inside a container. The container is designed to prevent contact with, or dispersion of, the radioactive material. Sealed sources are used in a wide array of industrial and medical applications (smoke alarms contain a sealed source). The use of a sealed source generally does not result in the generation of LLRW, and the sealed source itself is usually returned to the manufacturer after the radionuclide source has decayed. Entities that fall into this category include engineering firms, county highway commissions, bottling plants, and many different kinds of businesses and industries.

The second largest category of respondents includes medical facilities that use radionuclides with short half-lives for a variety of nuclear medicine diagnostic and therapeutic procedures. The use of these radioactive materials generates wastes that are initially radioactive. Due to the short half-life of the material, the wastes can be stored for days or weeks until the level of radioactivity present is indistinguishable from background. At that point, the waste can be disposed as ordinary waste. About 180 hospitals and cardiovascular, radiology, and oncology clinics, along with some colleges and universities, responded that they store waste for decay, but generate no other LLRW.

For many years, the number of entities actually generating LLRW and the annual volumes of waste have been falling. From 1980 to the late 1990s, the volume of waste requiring burial in a licensed LLRW disposal facility decreased by about 90 percent both within Michigan and nationally. Ever-increasing disposal costs encouraged the development of improved materials management practices and new waste treatment and processing technologies helping bring about this volume reduction. The cost of disposal, along with the uncertainty of access to disposal facilities, caused some facilities to cease the use of radioactive materials in order to avoid the generation of LLRW. The first generator survey conducted by the Authority in 1992 identified 49 generators of LLRW in Michigan. The 1997 survey identified only 28. This reduction occurred in the ranks of hospitals, universities, and research and industrial entities (typically small-quantity waste generators).

The data obtained from generators of LLRW in this survey and in the most recent previous survey (calendar year 1999) show that these trends of the past two decades may have leveled off. Both the volume of annual operational (or routine) wastes being generated, along with the number of entities that are actually generating the waste, appears to have stabilized. There were a total of 36 entities that indicated in this survey that they generated LLRW in 2002 or were storing LLRW that was generated in previous years.[2]

[2] Some LLRW generators may be missed in the survey due to unreturned survey forms.

Survey Results

Michigan Waste Generators

The data presented below summarizes the responses of 32 facilities that reported they generated LLRW in 2002, along with four other facilities that were still storing wastes previously generated. Those facilities can be summarized as follows:

Type of Generator	Generating LLRW	Storing LLRW
Academic	10	2
Government	1	1
Industry	10	1
Medical	7	
Utility	4	
Total	**32**	**4**

Appendix A provides a listing of the facilities included in this Table.

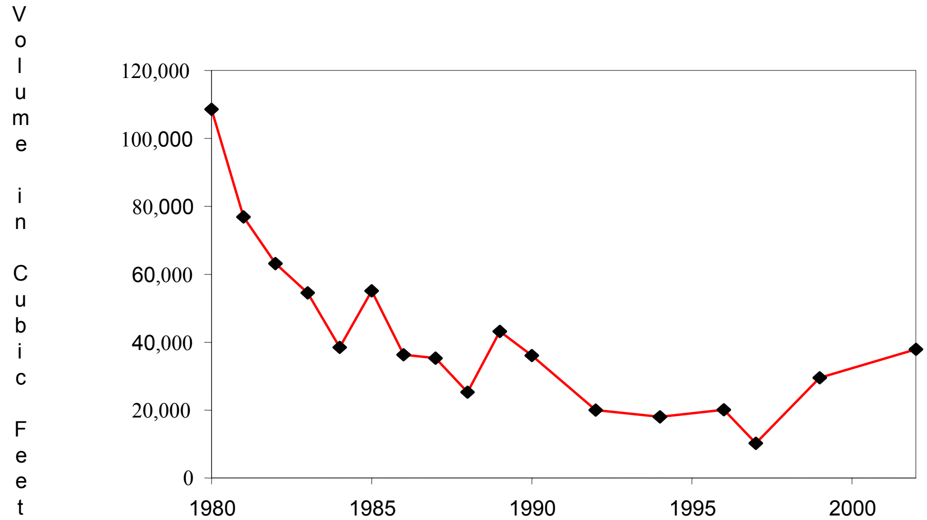

D.C. Cook steam generators

Skyrocketing disposal costs through the late 1980s and 1990s, along with uncertainty about the availability of disposal sites, led to the development and implementation of better waste management practices and to new waste treatment and processing techniques. Through this period, the volume of waste requiring licensed disposal following treatment or processing declined by about 90 percent. The dramatic decline in waste volumes experienced in Michigan has also occurred in other states and compacts, as well as nationally.

The chart below shows that Michigan's annual waste generation rate declined steadily through 1997 but shows an increase in waste volumes beginning in 1999. This increase was not due to a general increase in waste generation. Rather, the increase is almost entirely due to two special waste projects. The shipment for disposal of two steam generators from the D.C. Cook Nuclear Power Plant in 1999 comprised nearly 15,000 cubic feet of waste. These steam generators had been removed from the Plant itself several years earlier and had been safely stored on-site until their shipment in 1999. They were shipped by train and disposed intact at the Duratek, Inc., facility in Barnwell, South Carolina.

The other major contributor to the increase in waste volumes since 1999 has been the decommissioning of the Big Rock Point Nuclear Power Plant. The dismantlement of the Plant, near Charlevoix, results in the generation of significant quantities of material that must be treated as LLRW.

Annual Waste Volumes for Michigan: 1980-2002



Estimated Annual Waste Generation

The following table indicates the volume of waste, by generator category and waste class, that was generated in 2002. The data show that nuclear utilities generate the majority of Michigan's LLRW.

LLRW Generated in Calendar Year 2002
Requiring Disposal in a Licensed Facility

Type of Generator	Number of Generators	Cubic Feet Produced in 2002	Percent	Class A Waste	Class B Waste	Class C Waste	Mixed Waste
Academic	10	3,541	9.3%	3,356	16	0	170
Government	1	8	<0.1%	8	0	0	0
Industry	10	675	1.8%	663	10	0	2
Medical	7	259	0.7%	259	0	0	0
Utility	4	33,437	88.2%	32,542	245	635	15
Total	**32**	**37,920**	**100%**	**36,828**	**271**	**635**	**187**

Trends in Generation Rates Over the Next Five Years

Survey respondents were asked to estimate their annual waste generation rate for each of the next five years. The following table indicates that little change in waste volumes is expected in most generator categories. The significant decline anticipated in the utility category is likely due to the completion of the decommissioning of Big Rock Point. The utility waste volumes in 2005 and beyond represent the "operational waste" volumes for Michigan's three remaining nuclear power plants.

Type of Generator	2002	2003	2004	2005	2006	2007
Academic	3541	3,600	3,743	3,745	3,641	3,536
Government	8	8	8	8	8	8
Industry	675	417	320	240	251	346
Medical	259	251	254	256	259	261
Utility	33,457	32,830	20,030	12,930	12,830	12,230
Total	**37,920**	**37,106**	**24,355**	**17,179**	**16,989**	**16,399**

Waste Streams

Survey respondents were asked to provide the volume and activity for the different types of wastes that were generated. The following table indicates the volume and activity for a variety of waste types or "streams." The most significant of these waste streams (in volume or activity) are described in the following paragraphs. A description of all of the waste streams is included in Appendix B.

Volumes and Activity by Waste Stream

Waste Stream	Volume (Cubic Feet)	Percent of Volume	Total Activity (Millicuries)	Percent of Curies
Dry Active Waste	17,648	76.7%	14,954	3.1%
Ion Exchange Resins	2,100	9.1%	383,572	78.8%
Activated Equipment	275	1.2%	59,648	12.2%
Rubble, Sand, and Soil	1,206	5.2%	250	<0.1%
Sealed Sources	16	<0.1%	25,147	5.3%
Aqueous Liquids	996	4.3%	153	<0.01%
Organic Liquids	277	1.2%	57	0.1%
Oils	85	0.4%	250	<0.1%
Animal Carcasses	47	0.2%	564	0.1%
Biological Waste (Not Animal Carcasses)	0	0.0%	0	0.0%
Ash	0	0.0%	0	0.0%
Contaminated Hazardous Material	0	0.0%	0	0.0%
Sludge	0	0.0%	0	0.0%
Air Filter Media, Cartridges	0	0.0%	0	0.0%
Liquid Filter Media, Cartridges	0	0.0%	0	0.0%
Evaporator Concentrates	0	0.0%	0	0.0%
Medical Generators	0	0.0%	0	0.0%
TENORM	0	0.0%	0	0.0%

Dry Active Waste (DAW) consists of protective clothing, glassware, wiping rags, and other materials that may have been in contact with radioactive material and, thus, became contaminated with small amounts of radioactivity. DAW usually is the waste stream generated in the greatest volume. The curie content of DAW is usually very low relative to volume.

Ion exchange resins are filtration materials used in nuclear power plants to remove radioactive contaminants from circulating cooling water. Resins often form the second or third largest waste category in terms of both volume and activity. In this survey, resins account for the majority of total curies, primarily because the volume and curie content of the activated equipment, though appreciable, was lower than in many previous surveys.

Activated equipment or shielding are metal components from within a nuclear reactor or spent fuel pool. By being exposed to the radiation, these materials became radioactive themselves. While this waste category is usually small in volume, it often can contribute a significant percentage of the curie content in the total waste stream.

Rubble, sand, and soil are waste types characteristic of facility decommissionings as well as site remediation projects. The waste usually has very low concentrations of radioactive materials associated with it.

Volume in Storage

Generators were asked to identify the volume of waste currently in storage. Most generators will store waste for some period of time prior to disposal. Smaller waste generators may store waste for significant periods of time prior to shipping for disposal in order to have a quantity of waste that is economical to ship. The table below indicates, by generator category, the number of facilities reporting waste in storage and the volume of waste in storage.

Volume of Waste in Storage

Type of Generator	Facilities Reporting Waste in Storage	Cubic Feet LLRW in Storage	Class A Waste	Class B Waste	Class C Waste	Mixed Waste
Academic	9	1,484	1,459	0	0	25
Government	0	0	0	0	0	0
Industry	10	514	477	30	0	7
Medical	6	29	29	0	0	0
Utility	2	4,341	3,780	0	360	200
Total	**27**	**6,368**	**5,745**	**30**	**360**	**232**

The volumes of waste in storage cited above do not include waste volumes stored for decay. Decay in storage (DIS) is a management practice that can be used for wastes involving radionuclides that have relatively short half-lives (usually less than 90 days). Safely storing such wastes for a period of time equal to ten half-lives of the radionuclides results in a waste material that can be considered nonradioactive. As noted earlier, about 180 facilities, predominantly medical facilities, practice decay in storage.

From November 1990 until July 1995, Michigan waste generators were denied access to the nation's licensed LLRW disposal facilities. As a result, generators were forced to store waste on-site. By the time access to disposal facilities was regained, Michigan waste generators had approximately 100,000 cubic feet stockpiled. As a result of that problem, previous surveys have asked generators to indicate the volume of waste in storage that was produced during that period of access denial. Analysis of data from the 1999 survey revealed that only about 500 cubic feet of the waste then in storage was generated prior to resumption of access to disposal in mid-1995. For that reason, this current survey did not pursue that question.

Volume of Waste Disposed in 2002

There are two licensed LLRW disposal facilities in the United States that accept LLRW from Michigan generators.[3] These facilities are the Duratek, Inc., facility, located in Barnwell, South Carolina, and the Envirocare, Inc., facility, located 80 miles west of Salt Lake City, Utah.

The Duratek, Inc., facility serves as the regional disposal facility for the Atlantic Compact (comprised of Connecticut, New Jersey, and South Carolina). Under the terms of the Atlantic Compact, the Duratek, Inc., facility will accept waste from states other than Atlantic Compact states only until 2008, with an ever-decreasing annual cap on non-Compact waste through that year. The Duratek, Inc., facility accepts the full spectrum of LLRW – Class A, B, and C waste. It is the only disposal option for generators of Class B and C wastes in the majority of the states, including Michigan. The Duratek, Inc., facility accepted a total of about 42,000 cubic feet of waste and about 100,000 curies in 2002.[4]

The Envirocare, Inc., facility was established independent of the interstate compact structure but operates with some measure of oversight from the Northwest Compact (Utah is a member state). The Envirocare, Inc., facility can accept waste from generators in all states. The facility was initially established to accept high-volume, low-activity wastes such as contaminated soils from a site remediation project. Through recent license amendments, however, the facility can now accept all Class A waste. It is not licensed to accept Class B and C waste. The facility accepts much larger volumes of waste than the Duratek, Inc., facility but a much smaller curie content. In 2002 the Envirocare, Inc., facility accepted almost 4 million cubic feet of waste with a curie content of 2,183 curies.[4]

The table below reflects, by generator category, the number of facilities that has shipped waste for disposal during 2002, the waste volume as disposed, and the final destination of the waste. Certain waste types were shipped to other facilities besides the two land disposal facilities. For instance, there are several companies that provide for the incineration of aqueous liquids.

The "as disposed" volume figures reflect the volume of waste actually placed in the land disposal facility. Many waste streams can be significantly reduced in volume through treatment and processing prior to burial. Thus, the volumes reflected in this table are smaller than the volumes generated.

[3] A third licensed disposal facility, the U.S. Ecology site located near Richland, Washington, accepts waste only from the 11 states that comprise the Northwest Compact and the Rocky Mountain Compact.
[4] Data from the U.S. Department of Energy's Manifest Information Management System.

Volume of Waste Disposed in 2002 (in Cubic Feet)

Type of Generator	Generators Shipping for Disposal in 1999	Volume of Waste Disposed	Volume Shipped to Duratek*	Volume Shipped to Envirocare*	Volume Shipped to Other Facilities*
Academic	7	393	317 (4)	76 (1)	0
Government	1	8	0	8 (1)	0
Industry	3	464	83 (1)	1 (1)	351 (1)
Medical	5	670	238 (3)	15 (1)	418 (1)
Utilities	4	8,253	2,355 (3)	5,898 (2)	0
Total	**20**	**9,788**	**2,992 (11)**	**5,995 (6)**	**769 (2)**

* Numbers in parentheses indicate the number of generators that shipped to a particular site.

Other Waste Management Methods

The survey asked respondents to identify the various waste management methods that were used at their facilities. Many facilities indicate that more than one management method is used.

Waste Management Methods

Waste Management Methods	Number of Respondents
Decay to background	27
Return to manufacturer	12
On-site incineration	3
Off-site incineration	11
Controlled release off-site to air, water, or sanitary sewer pursuant to U.S. NRC regulations (10 CFR 20)	15
Refrigerated or frozen awaiting licensed disposal facility	5
Noncompacted awaiting licensed disposal facility	14
Compacted awaiting licensed disposal facility	12
Solidified awaiting licensed disposal facility	4
Dewatered awaiting licensed disposal facility	5
Curtailment of LLRW generation (elimination or substitution of activities previously generating LLRW)	12
Off-site treatment with return for storage	0
Brokerage storage for decay	3
Other	4

Decay to Background: Hospitals, universities, and research institutions often use radionuclides with relatively short half-lives. The U.S. NRC permits wastes containing radionuclides with half-lives of up to 90 days or less to be stored until the radioactivity has decayed to background--a period recognized as being equal to ten half-lives for any particular radionuclide. Almost all universities and medical facilities indicated that some wastes were stored for decay.

Return to Manufacturer: A "sealed source" is a radioactive material sealed in a container to prevent contact with, or dispersion of, the radioactive material. Sealed sources are used in a variety of different ways in medical treatment and in industrial and manufacturing processes. Examples include devices used to examine welded joints, to test the thickness of paper, and to control fluid levels in bottling plants. Sealed sources are often returned to the manufacturer after the radionuclide source has decayed.

On-site Incineration: Facilities may be licensed to incinerate certain waste material under strict limits imposed by the U.S. NRC under 10 CFR Part 20. Three licensees incinerate some of their LLRW on-site. The resulting ash is treated as LLRW.

Off-site Incineration: There are several commercial LLRW incinerators operating in the country currently. The resulting ash is treated as LLRW. Ash may be solidified to avoid dispersal problems.

Scintillation fluids, chemical solutions often used in biomedical research, are often incinerated, leaving no residual waste.

Controlled Release to Air, Water, or Sanitary Sewer: U.S. NRC regulations allow for the discharge of small concentrations of radionuclides to the air, water, or sanitary sewage systems. The concentration limits established by the NRC for such releases are very conservative. For instance, the concentrations for sewer release are set so that a person would get no more than 500 millirem of exposure in a year if the sewer discharge was the person's only source of drinking water.

Refrigerated or Frozen: Biological wastes, particularly animal carcasses used in laboratory experiments, are often frozen to forestall biological deterioration if disposal is not possible or delayed. Hospitals, universities, and research institutions may use this technique.

Non-Compacted Awaiting Licensed Disposal Facility: Many waste generators, particularly the small quantity generators, simply containerize their wastes in drums until disposal is available. The waste materials are dry solids.

Compacted Awaiting Licensed Disposal Facility: Some waste generators use compactors to reduce the volume of dry solid wastes. Generators may have their own compactor or send waste to a commercial compactor for treatment and return.

Solidified Awaiting Licensed Disposal Facility: Some liquid or wet wastes can be solidified by the use of concrete, asphalt, or epoxies. The resulting waste form is more stable; however, often the volume is increased substantially through the addition of the solidifying agent. Liquid wastes are not permitted in licensed LLRW disposal facilities.

Dewatered Awaiting Licensed Disposal Facility: Ion exchange resins used in nuclear power plants to remove radioactive contaminants from circulating cooling waste are often "dewatered" or dried prior to being placed into storage or sent for disposal.

Curtailment of LLRW Generation: Over the past decade, the volume of LLRW being generated has declined significantly, due to better waste management practices, new waste treatment technologies, and eliminating or substituting activities or procedures that would generate LLRW. Due to the uncertainty of disposal and the cost of both storage and disposal, most waste generators continue to search for ways to reduce the amounts of LLRW being produced.

Off-site Treatment with Return for Storage: During the years when disposal was not possible, Michigan generators were still able to send wastes out-of-state to commercial waste treatment or processing facilities. The waste was returned to the individual generator following compaction or incineration to await final disposal. Now that wastes can be disposed, no generators are having wastes treated and returned.

Brokerage Storage for Decay: Some wastes with radionuclides of short half-lives can be stored until decayed. If a generator has no space to store waste for decay, waste can be sent to a brokerage for storage. After the radionuclides have sufficiently decayed, the material can be disposed as nonradioactive waste.

Brokerage Services

Survey respondents were asked whether or not a brokerage service was used to manage their LLRW. A brokerage service usually picks up waste from a variety of waste generators and then properly packages, manifests, and ships the waste for disposal. The brokerage service may also provide some waste treatment or processing or send it to a third party for processing prior to disposal.

Most LLRW generators made use of brokerage services. Of 32 waste generators, 23 indicated that a brokerage service was used for some portion of their overall waste management scheme.

Off-Site Waste Treatment and Processing

Generators were also asked to identify any commercial waste treatment or processing companies (separate from brokerage services) that were used to treat wastes prior to disposal. Nuclear power plants utilize waste treatment and processing more than other generators. The four nuclear power plants each indicated that a variety of commercial waste treatment and processing services were used to volume-reduce and stabilize their LLRW. Among the 27 nonutility generators, only 11 utilized commercial treatment or waste processing.

The chart below indicates the number of facilities, by type of generator, that indicated employment of a waste brokerage and/or off-site waste processor to help manage LLRW.

Type of Generator	Number of Generators Utilizing Brokerage Services	Number of Generators Utilizing Off-Site Waste Treatment
Academic	9	1
Government	1	0
Industry	7	3
Medical	4	1
Utility	2	4
TOTAL	**23**	**9**

Appendices

Appendix A

2002 Low-Level Radioactive Waste Generator Survey

Colleges/Universities	County	Generating LLRW	Storing Only
Albion College	Calhoun		x
Calvin College	Kent	x	
Central Michigan University	Isabella		x
Eastern Michigan University	Washtenaw	x	
Kettering University	Genesee	x	
Michigan State University	Ingham	x	
Michigan Technological University	Houghton	x	
Northern Michigan University	Marquette	x	
Oakland University	Oakland	x	
University of Michigan	Washtenaw	x	
Wayne State University	Wayne	x	
Western Michigan University	Kalamazoo	x	
Government			
U.S. Army TACOM	Macomb		x
U.S. Dept. of Commerce (GLERL)	Washtenaw	x	
Industry			
Aastrom Biosciences	Washtenaw	x	
Alma Iron and Metal	Gratiot		x
Cayman Chemical	Washtenaw	x	
Dana-Perfect Circle Division	Muskegon	x	
The Dow Chemical Company	Midland	x	
Esperion Therapeutics, Inc.	Washtenaw	x	
General Motors R & D Center	Macomb	x	
H.C. Starck, Inc.	Branch	x	
Michigan Biotechnology Inst.	Ingham	x	
Pharmacia & Upjohn Company	Kalamazoo	x	
TSRL, Inc.	Washtenaw	x	
Hospitals/Medical Centers			
Childrens' Hospital of Michigan	Wayne	x	
Cardinal Health	Genesee	x	
Cardinal Health	Ottawa	x	
Cardinal Health	Wayne	x	
Henry Ford Health Systems	Wayne	x	
VA Medical Center	Washtenaw	x	
William Beaumont Hospital	Oakland	x	
Nuclear Power Plants			
Consumers Energy - Big Rock Point	Charlevoix	x	
Consumers Energy - Palisades	Van Buren	x	
Detroit Edison Co. - Fermi II	Monroe	x	
Indiana-Michigan Power Co. - D.C. Cook	Berrien	x	

Appendix B

Description of Waste Streams

Activated Equipment (or Shielding): Tools, instruments, equipment, and lead shielding made radioactive by irradiation from a nuclear reactor or spent fuel pool.

Air Filter Media, Cartridges: Air filters or the media used within air filters, such as charcoal or cellulose fibers.

Animal Carcasses: Radioactivity contaminated animal carcasses or body parts usually resulting from animal research. Animal carcasses present a special storage problem in that they often require freezing to inhibit biological degradation.

Aqueous Liquids: Wastes that are dissolved in water. Liquid waste must be solidified before shipment to a disposal facility. Liquids cannot be accepted for disposal.

Ash: Incinerating LLRW results in substantial volume reduction but most of the radioactivity is still present in the ash. Ash is often solidified with cement, asphalt, or other material prior to disposal or storage.

Biological Waste: Other biological waste may include animal bedding and excreta and laboratory culture media.

Contaminated Hazardous Material: Wastes that have hazardous constituents or properties as designated by U.S. Environmental Protection Agency regulations (40 CFR 261) as well as contamination with radionuclides. This type of waste is also referred to as “mixed waste.”

Dry Active Waste (DAW): Solid waste that commonly consists of protective clothing, glassware, paper, cloth, and plastics that may have been contaminated with radioactive material. Some DAW can be compacted or incinerated.

Evaporator Concentrates: Evaporation of contaminated water is a common treatment method at nuclear power plants. The concentrated residue produced during the process is solidified before disposal.

Ion Exchange Resins: Organic polymer materials used to remove radioactive contaminants from circulating cooling water and used for other water treatment systems within nuclear power plants.

Liquid Filter Media, Cartridges: Filters or filter media used to remove radionuclides from water.

Medical Generators: A commercially available device used to create a short-lived radionuclide (to be used in a medical application) from a parent radionuclide. The most widely used medical generator is used to produce technetium-99m from a molybdenum source. The device is usually returned to the manufacturer at the end of its useful life.

Oils: Lubricating or machine oil that has become contaminated with radioactive materials.

Organic Liquids: Chemical compounds such as alcohols or solvents such as benzene, xylene, and toluene that have been contaminated with radioactive materials.

Rubble, Sand, and Soil: Concrete, gravel, soil, or other building rubble contaminated with radioactive materials. These wastes are usually generated in the process of decommissioning a licensed facility.

Sealed Sources: A radioactive source sealed in a container to prevent contact with, or dispersion of, the radioactive material during its use. Sealed sources are used in a wide variety of medical, research, industrial, and construction applications.

Sludge: Produced when filtering contaminants, sludges include powdered ion-exchange resins, diatomaceous earth, suspended solids, silica, and metal oxides.

TENORM: Technologically-Enhanced Naturally Occurring Radioactive Material results from naturally occurring radionuclides being concentrated by some man-made process. For example, radium scale can develop on oil and gas well piping.

Appendix C

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

LOW-LEVEL RADIOACTIVE WASTE AUTHORITY

LOW-LEVEL RADIOACTIVE WASTE MANAGEMENT SURVEY

2003

Under Section 18(a) of Act 434 (P.A. of 1994), generators of low-level radioactive waste (LLRW) are required to provide information to the Michigan Low-Level Radioactive Waste Authority on an annual basis. Information requested includes waste volumes, curie content of the waste, and other data relevant to waste management and disposal. This survey will fulfill the generator's reporting requirements for 2002.

This survey is due April 18, 2003

Please complete and return this survey to the Low-Level Radioactive Waste Authority in the enclosed self-addressed return envelope or using the following address:

Low-Level Radioactive Waste Authority
Michigan Department of Environmental Quality
P.O. Box 30241
Lansing, MI 48909-7741

If other facility locations are included in this response, please attach a list identifying them.

If you have any questions concerning this survey, contact Thor Strong, Acting Commissioner of the Michigan Low-Level Radioactive Waste Authority, at 517/241-1252.

Facility Name and Address: ______________________________

____

____

____

Contact Person: ______________________________

Title: ______________________________

Telephone Number: ______________________________

LOW-LEVEL RADIOACTIVE WASTE MANAGEMENT SURVEY

1. If your facility has a U.S. Nuclear Regulatory Commission (NRC) License Number, please enter that here. If all radioactive materials are possessed under an NRC General License, indicate "GL":
____

2. Do you generate LLRW which, due to short half life of isotopes, may be stored for decay and eventually disposed as non-radioactive waste? YES____ NO____

For all remaining questions, DO NOT include waste that is stored for decay and which can then be disposed as non-radioactive waste.

3. A. Does your facility generate radioactive waste which requires disposal in a licensed LLRW disposal facility? YES____ NO____

   B. If NO, is your facility storing any radioactive material or waste which is now awaiting disposal? YES____ NO____

If you answered "NO" to both 3A and 3B, it is not necessary to complete the rest of the survey. Please return the survey to the Low-Level Radioactive Waste Authority.

If you answered "YES" to either or both 3A and 3B, please complete all remaining questions that are appropriate and applicable.

WASTE MANAGEMENT

The purpose of this section is to collect information regarding your current waste management program, and what changes might take place in the next few years.

4. A. Please estimate the volume of LLRW generated in calendar year 2002 that has been disposed, or will require disposal, in a licensed disposal facility.

   Total Cubic Feet __________

   B. If known, break down the total volume entered in 8A into waste classes. Appendix __ provides a description of waste classes.

   Class A ____ Class B ____ Class C ____ Mixed ___ Don't Know ____

5. Please estimate the volume (in cubic feet) of LLRW that your facility will generate in each of the next five years. If you are unsure of Waste Class, enter as Class A.

	2003	2004	2005	2006	2007
Class A					
Class B					
Class C					
Mixed					

6. Use the following table to characterize the LLRW generated in calendar year 2002. Please indicate the volume, total activity and principle radionuclides for each waste stream that will require disposal in a licensed LLRW facility. The estimated volume for all waste streams reported should equal the total cubic feet volume reported in 4A.

A. Dry Active Waste
B. Medical Generators
C. Aqueous Liquids
D. Organic Liquids (not oils)
E. Oils
F. Animal Carcasses
G. Biological Waste (exclude animal carcasses)
H. Ash
I. Activated Equipment or Shielding (radioactive by irradiation)
J. Contaminated Hazardous Material
K. Rubble, sand, soil etc.
L. Sludge
M. Evaporator Concentrates
N. Air Filter Media, Cartridges
O. Liquid Filter Media, Cartridges
P. Ion Exchange Resins
Q. Sealed Sources
R. TENORM

Waste Stream	Estimated Volume (Cubic Feet)	Total Activity (Indicate units: *μCi, mCi, Ci)*	Principle Radionuclides

7. Check each waste management method currently used, either by you at your facility, or by an off-site waste processor, to manage your LLRW.

A. __ Decay to background
B. __ Return to manufacturer or supplier
C. __ On-site incineration
D. __ Off-site incineration
E. __ Controlled release pursuant to 10CFR20
F. __ Refrigerated or frozen, prior to disposal
G. __ Non-compacted prior to licensed disposal
H. __ Compacted prior to licensed disposal
I. __ Solidified prior to licensed disposal
J. __ Dewatered prior to licensed disposal
K. __ Curtailment of LLRW generation (elimination or substitution of activities previously generating LLRW)
L. __ Off-site treatment with return for storage
M. __ Brokerage storage for decay
N. __ Other (Please describe)
____
____
____
____

8. If your facility uses a waste brokerage service (a company which packages and collects waste) so that you do not have to deal with a disposal site directly, please provide the name of the company(s) and the state(s) where the broker(s) is located.

____
____

9. If your facility shipped waste off-site for treatment or processing prior to disposal (incineration, compaction, etc.), identify the waste processor(s) and the state(s) where the processor(s) are located.

____
____

WASTE DISPOSAL

10. Please estimate the volume of waste shipped for disposal (either directly or through a broker or processor) at a licensed LLRW disposal facility in calendar year 2002.

Total Cubic Feet ________

11. Please identify the volume (in cubic feet) of waste sent to the following disposal sites during calendar year 2002:

Chem-Nuclear Systems, Inc. (Barnwell, South Carolina)	________
Enviro-Care of Utah, Inc. (Clive, Utah)	________
U.S. Ecology (Richland, Washington)	________
Other (please identify)	________
Don’t know	________

WASTE IN STORAGE

12. A. Please estimate the cubic feet of LLRW, currently in storage, that will require disposal in a licensed LLRW disposal facility. Please include in this estimate any waste currently held off-site by a broker or processor.

Total Cubic Feet ________

B. If known, break down the total volume entered in 4A by waste class:

Class A _____	Class B _____	Class C _____	Mixed _____	Don't Know ____

13. What difficulties, if any, are you experiencing in your effort to ship stored wastes for disposal? Please explain:

____

____

____

Signature: ____ Date: ___________________

Facility: ____